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# UNITED STATES PATENT APPLICATION

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**FOR**

# WASHING MACHINE AND CONTROL METHOD THEREOF

**[0001]** This application claims the benefit of Korean Application No. 10-2002-0078336 filed on December 10, 2002, which is hereby incorporated by reference.

## BACKGROUND OF THE INVENTION

Field of the Invention

**[0002]** The present invention relates to a washing machine and control method thereof, and more particularly to an apparatus for sensing water leakage in a washing machine, by which operation is stopped when water leakage is sensed.

Discussion of the Related Art

**[0003]** To perform a washing step, a contemporary washing machine is typically provided with a tub to be filled with water from a commercial source. More specifically, upon receiving a wash execution command from a user, the tub is filled with water supplied through a variety of hoses and valves. A contemporary washing machine is shown in FIG. 1.

**[0004]** Referring to FIG. 1, a drum-type washing machine comprises a cylindrical tub 2 installed within a cabinet 1 forming an enclosure of the interior of the washing machine. A drum 3 is rotatably installed inside the tub, and a spider 3a is employed to fix a drive shaft 3b to the rear side of the drum. The drive shaft 3b penetrates the center of the rear side of the tub 2, to be connected to a rotor 11 of a motor unit 10, which includes a stator 12.

**[0005]** Meanwhile, an inlet hose 5, disposed above the tub 2 and routed through the cabinet 1 from an upper point of the rear side of the cabinet, communicates with the tub via a main inlet valve 4. When the main inlet valve 4 is turned on, water is supplied to the tub 2 via the inlet hose 5 until a predetermined water level is reached.

**[0006]** There may be instances, however, where the water supplied as above leaks from the tub 2, or elsewhere, into the interior of the cabinet 1 and may accumulate. In such

an event, the leaking water, and particularly the accumulated water, corrodes internal components of the washing machine, especially those installed in the lower regions of the cabinet 1, and contaminates the installation area of the washing machine by leaking through the bottom of the cabinet. Moreover, such leakage slows the filling of the tub to the predetermined level, thus prolonging the wash cycle and wasting water.

**[0007]** Accordingly, there is a need for some means for controllably shutting off the main inlet valve 4 while the water is filling the tub 2 to perform a washing step.

## SUMMARY OF THE INVENTION

**[0008]** Accordingly, the present invention is directed to a washing machine and control method thereof that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

**[0009]** An object of the present invention, which has been devised to solve the foregoing problem, lies in providing a washing machine and control method thereof, which prevents a corrosion of internal components of the washing machine and a contamination of an installation area of the washing machine.

**[0010]** It is another object of the present invention to provide a washing machine and control method thereof, which enables a main inlet valve to be controllably shut off while filling a tub with water to perform a washing step.

**[0011]** It is another object of the present invention to provide a washing machine and control method thereof, which prevents an excessive consumption of water.

**[0012]** It is another object of the present invention to provide a washing machine and control method thereof, which prevents a prolonged wash cycle in the event of a water leakage condition.

**[0013]** Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art upon examination of the following or may be learned from a practice of the invention. The objectives and other advantages of the invention will be realized and attained by the subject matter particularly pointed out in the specification and claims hereof as well as in the appended drawings.

**[0014]** To achieve these objects and other advantages in accordance with the present invention, as embodied and broadly described herein, there is provided a washing machine comprising leakage containment means for accumulating leaking water; and leakage detection means for detecting an accumulation of leaking water in the leakage containment means. The leakage containment means comprises a cabinet having a plurality of sides and a bottom, and the leakage detection means comprises a switch activated by a predetermined level of accumulation of leaking water in the leakage containment means.

**[0015]** The leakage detection means of the present invention is facilitated by a switch support for supporting the switch at its upper end and a float member having a predetermined buoyancy. The switch support is connected at its lower end to an inner surface of the bottom of the cabinet. The support has an interior space of a predetermined height and at least one perforation allowing water flow from the leakage containment means to the interior space of the switch support. The float member is disposed in the interior space of the switch support such that the float member is brought into contact with the switch by floating, to thereby activate the switch, if the accumulation of leaking water in the leakage containment means reaches the predetermined level. Preferably, the switch is a tactile switch having a sensitivity allowing operation by the buoyancy of the float member.

**[0016]** In another aspect of the present invention, there is provided a washing

machine control method comprising steps of supplying water to a tub via main inlet valve; determining whether a water leakage condition exists; and shutting off the supply of water to the tub by controlling the main inlet valve, if it is determined that a water leakage condition exists.

**[0017]** It is to be understood that both the foregoing explanation and the following detailed description of the present invention are exemplary and illustrative and are intended to provide further explanation of the invention as claimed.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0018]** The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

**[0019]** FIG. 1 is a cross-sectional view of a contemporary washing machine;

**[0020]** FIG. 2 is a cross-sectional view of a washing machine according to the present invention;

**[0021]** FIG. 3 is a cross-sectional view of a washing machine according to the present invention, illustrating an operation of an apparatus for sensing water leakage; and

**[0022]** FIG. 4 is a flowchart of a washing machine control method according to the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[0023]** Reference will now be made in detail to the preferred embodiment of the present invention, examples of which are illustrated in the accompanying drawings.

Throughout the drawings, like elements are indicated using the same or similar reference designations where possible.

**[0024]** Referring to FIG. 2, an apparatus for sensing water leakage in a washing machine according to the present invention includes a leakage containment means 20 for accumulating water leaking from a tub (not shown), or elsewhere within the interior of a cabinet (not shown) of the washing machine, and a leakage detection means 30 for detecting an accumulation of leaking water in the leakage containment means.

**[0025]** The leakage containment means 20 comprises a plurality of side panels 21 each having a bottom flange 21a, formed as an inwardly bent bottom-edge surface of the respective side panels, and a bottom panel 22 for closing a bottom opening formed by the side panels. The perimeter of the bottom panel 22 rests atop the bottom flanges 21a of the side panels 21 and is secured thereto, to form a seal with the side panels, by a sealing means comprised of compression means, i.e., a plurality of bolts 24 passing through the perimeter of the bottom panel and the bottom flanges, and a packing member 23 inserted between the bottom flanges and the bottom panel and compressed by the compression means. The side panel 21 forms the sides of the cabinet of the washing machine and may be formed as a contiguous piece or by connecting the side panels, and the bottom panel 22 forms the bottom of the cabinet of the washing machine.

**[0026]** The leakage detection means 30 comprises a tactile switch 32, activated by a predetermined level of accumulation of leaking water in the leakage containment means 20; a cylindrical switch support 25 of a predetermined height, having at least one perforation 25a formed in its sidewall to allow water to flow from the leakage containment means 20 to an interior space of the switch support; and a float member 31 having a predetermined buoyancy, disposed in the interior space of the switch support, to be brought into contact with the tactile

switch by floating, and thereby activate the tactile switch, if the accumulation of leaking water in the leakage containment means reaches the predetermined level. The switch support 25 is centrally provided on the bottom panel 22, with its lower end connected to the bottom panel and its upper end provided with a switch mount 26 for securely positioning the tactile switch 32 above the float member 31. The switch mount 26 includes an annular flange 26a, protruding downward from its perimeter, and a plurality of hooks 26b formed at a lower end of the annular flange 26, to be respectively inserted in a plurality of corresponding hook holes 25b correspondingly formed in the outer surface of the switch support 25, for coupling the switch mount to the switch support.

**[0027]** The leakage detection means 30 outputs a leakage detection signal to a microcomputer 40 via a lead wire 34 connected to the tactile switch 32, which may be activated by closing or by opening. The microcomputer 40 generates respective control signals to a main inlet valve 50 for controlling the supply of water to the tub and to a warning means 60 such as a display panel or audio signal generator for informing the user of the status of the washing machine.

**[0028]** Referring to FIG. 4, illustrating a washing machine control method according to the present invention explained with respect to FIG. 3, a water supply operation is initiated in a step S1, whereby the tub of the washing machine is to be filled via the main inlet valve 50 to a predetermined level for performing a washing step. In the event that a water leakage condition exists, the leaking water accumulates in the bottom of the leakage containment means 20 and flows into the interior space of the switch support 25 through the perforation 25a, thus raising the float member 31. If the leakage is excessive, namely, of a sufficient rate or accumulation, the float member 31 is raised to a predetermined elevation determining the existence of a water leakage condition, whereby the tactile switch 32 is activated and a

leakage detection signal is generated.

**[0029]** Accordingly, it is determined in a step S2 whether the above-described water leakage condition exists. If so, a leakage detection signal is generated, to be output from the tactile switch 32 for input to the microcomputer 40 via the lead wire 34, whereupon the microcomputer outputs in a step S3 a first control signal to the main inlet valve 50, shutting off the supply of water to the tub. Meanwhile, a second control signal is output in a step S4 to the warning means 60.

**[0030]** Otherwise, that is, when the float member 31 is not raised to the predetermined elevation and it is therefore determined that no water leakage condition exists, the supply of water proceeds to completion in a step S5 so that washing can be performed in a step S6.

**[0031]** As described above, the washing machine and control method thereof according to the present invention controllably shuts off a main inlet valve in the event of a water leakage condition, thereby preventing a corrosion of internal components of the washing machine and a contamination of an installation area of the washing machine. In the event of a water leakage condition, the present invention also prevents an excessive consumption of water and a prolonged wash cycle.

**[0032]** It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover such modifications and variations, provided they come within the scope of the appended claims and their equivalents.